

Name:

Solution Key

All trigonometric functions that are sine or cosine or transformations of sine or cosine are called "SINUSOIDAL FUNCTIONS". In this packet, you will see many examples of transformations of sine and cosine that result in one transformation or some combination of one or more transformations, such as:

a. Vertical Stretch or Vertical Compression, A. $A = \frac{Max - Min}{2}$

Fact: $|A| = \text{Amplitude}$

b. Vertical Shift Up or Vertical Shift Down, D. $D = \frac{Max + Min}{2}$

c. Horizontal Stretch or Horizontal Compression, B. $B = \frac{2\pi}{P}$ & $P = \frac{2\pi}{B}$, where

Fact: $P = \text{Period}$

d. Horizontal Shift Left or Horizontal Shift Right (also called Phase Shift), C.

e. Reflection over the x-axis, which involves a negative in front of A

Fact: The standard form of a sinusoidal function equation is either
 $f(x) = A \sin(B(x - C)) + D$ or $f(x) = A \cos(B(x - C)) + D$

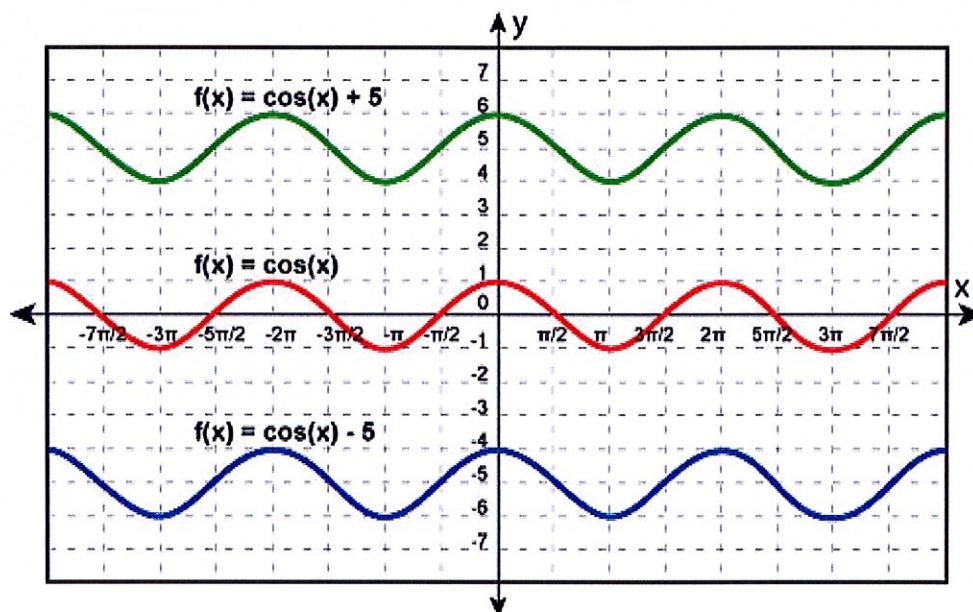
Fact: Every sine curve is just a phase shifted cosine curve and vice versa.

Fact: Any sinusoidal equation can be written with either sine or cosine. The only difference between the two options is the C or the Phase Shift.

1. Describe briefly the one transformation of the graph of $f(x) = \cos(x)$ that results in the sinusoidal graph shown below in GREEN.

Transformation 1: _____ D= 5

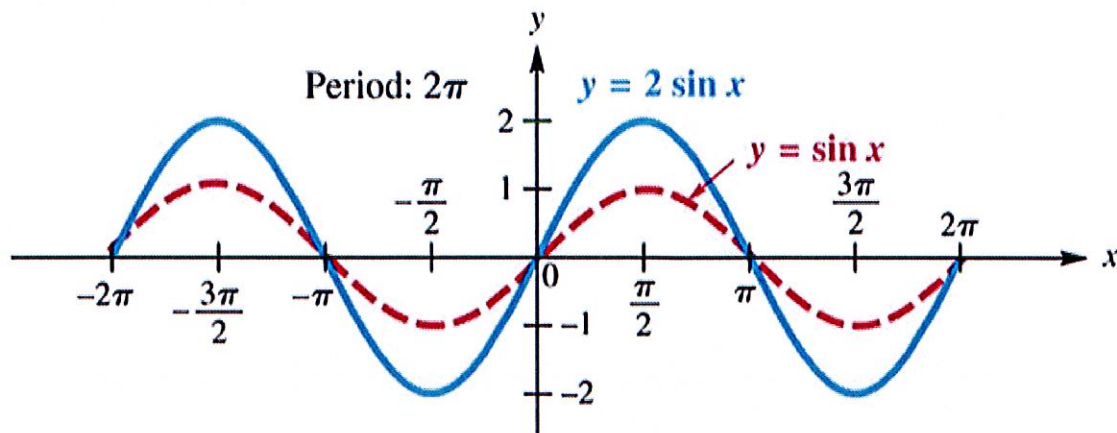
Amplitude: $|A| =$ 1 Period: P= 2π



2. Describe briefly the one transformation of the graph of $f(x) = \sin(x)$ that results in the sinusoidal graph shown below in BLUE.

Period: P= 2π

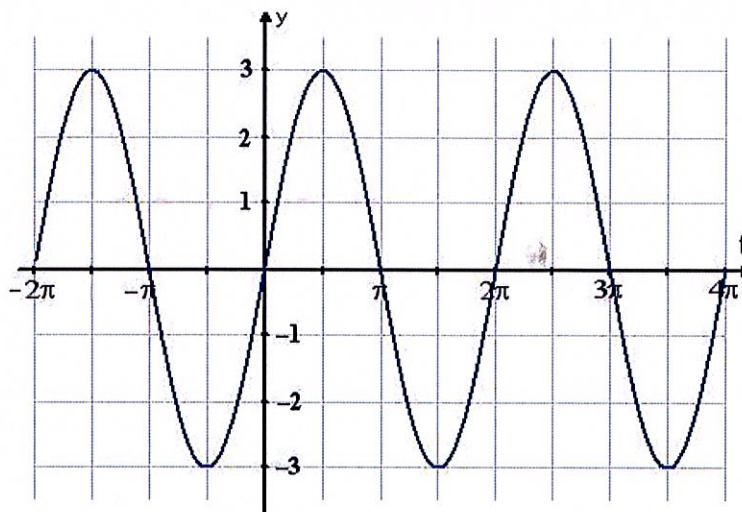
Transformation 1: _____ $|A| =$ 2



3. Describe briefly the one transformation of the graph of $f(x) = \sin(x)$ that results in the sinusoidal graph shown below. Period: $P = 2\pi$

Transformation 1: Vert. stretch by a factor of 3 $|A| = 3$

What is an equation of this transformation? $f(x) = 3\sin x$

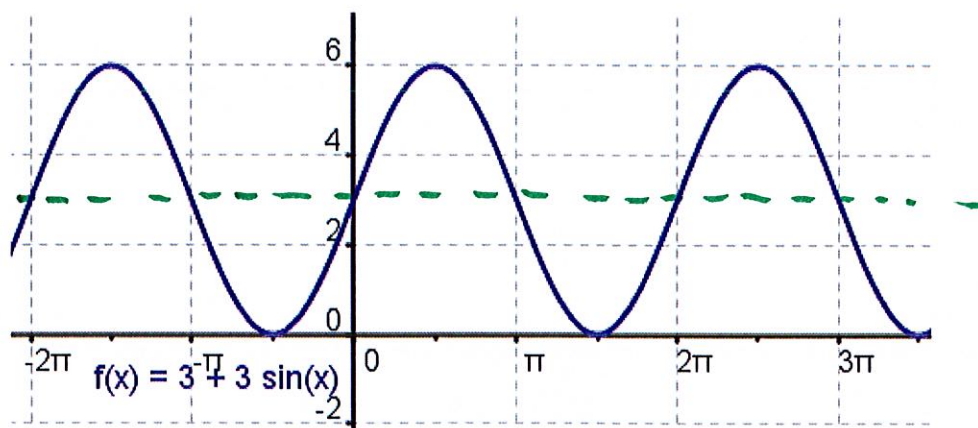


4. Describe briefly the two transformations of the graph of $f(x) = \sin(x)$ that result in the sinusoidal graph shown below. Period: $P = 2\pi$

Transformation 1: Vert. stretch by a factor of 3 $|A| = 3$

Transformation 2: Vert. shift up 3 units $D = 3$

What is an equation of this transformation? $f(x) = 3\sin x + 3$



5. Describe briefly the two transformations of the graph of $f(x) = \sin(x)$ that result in the sinusoidal graph shown below. Period: $P = 120^\circ$ or $\frac{2\pi}{3}$

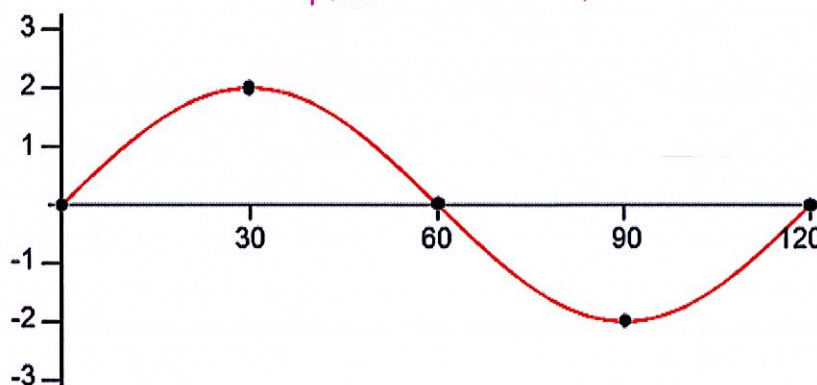
Transformation 1: Vert. stretch by a factor of 2 $|A| = 2$

Transformation 2: Hor. compression by a factor of $\frac{1}{3}$ $B = 3$

What is an equation of this transformation? $f(x) = 2\sin(3x)$

$$B = \frac{2\pi}{P}$$

$$B = \frac{2\pi}{\frac{120^\circ}{3}} = 3$$



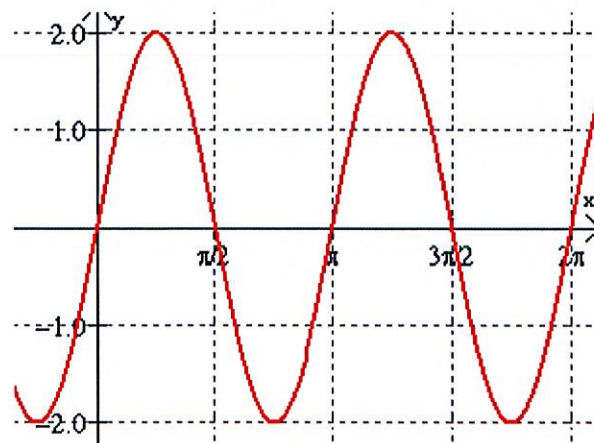
6. Describe the two transformations of the graph of $f(x) = \sin(x)$ that result in the sinusoidal graph shown below. Period: $P = \pi$

Transformation 1: Vert. stretch by a factor of 2 $|A| = 2$

Transformation 2: Hor. compression by a factor of $\frac{1}{2}$ $B = \frac{2\pi}{\pi} = 2$

What is an equation of this transformation?

$$f(x) = 2\sin(2x)$$



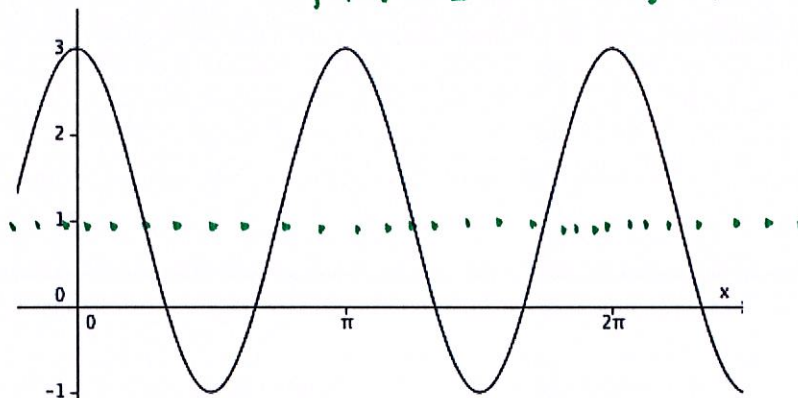
7. Describe the three transformations of the graph of $f(x) = \cos(x)$ that result in the sinusoidal graph shown below. Period: $P = \underline{\pi}$

Transformation 1: Vert. stretch by a factor of 2 $|A| = \underline{2}$

Transformation 2: Hor. compression by a factor of π $B = \underline{\frac{2\pi}{\pi} = 2}$

Transformation 3: Vert. shift up 1 unit $D = \underline{1}$

What is an equation of this transformation? $f(x) = 2\cos(2x) + 1$



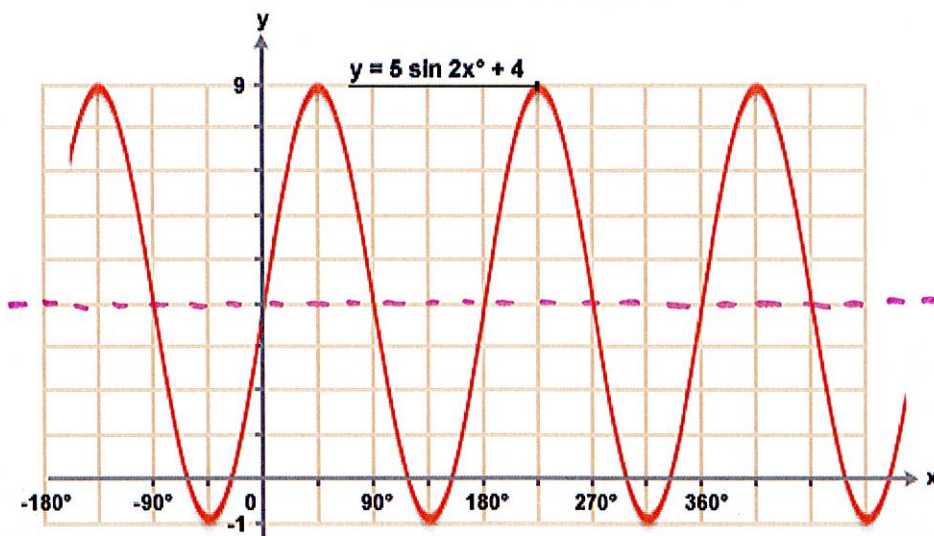
8. Describe the three transformations of the graph of $f(x) = \sin(x)$ that result in the sinusoidal graph shown below. Period: $P = \underline{180^\circ \text{ or } \pi}$

Transformation 1: Vert. stretch by a factor of 5 $|A| = \underline{5}$

Transformation 2: Hor. compression by a factor of π $B = \underline{\frac{2\pi}{\pi} = 2}$

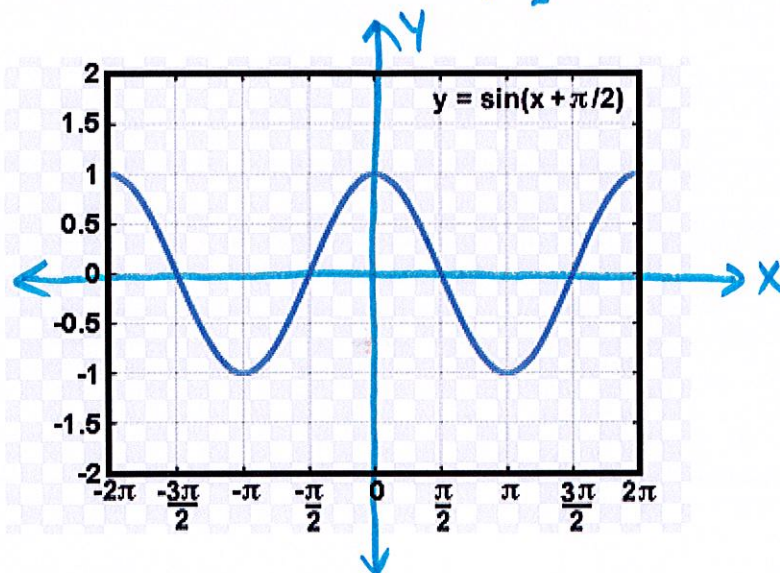
Transformation 3: Vert. shift up 4 units $D = \underline{4}$

What is an equation of this transformation? $f(x) = 5\sin(2x) + 4$



9. Describe the one transformation of the graph of $f(x) = \sin(x)$ that results in the sinusoidal graph shown below. Period: $P = 2\pi$

Transformation 1: Hor. shift left by $\frac{\pi}{2}$ $C = -\frac{\pi}{2}$



10. Describe the three transformations of the graph of $f(x) = \sin(x)$ that result in the sinusoidal graph shown below. Period: $P = \frac{2\pi}{3}$

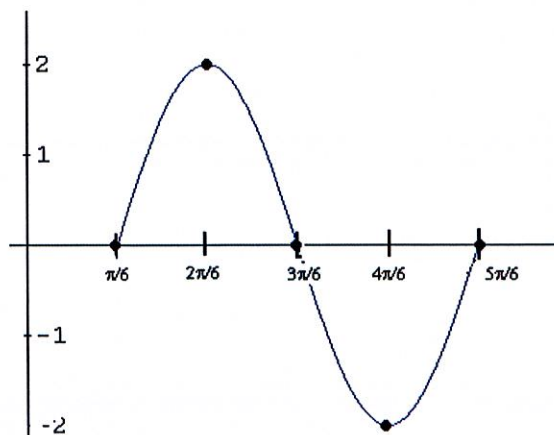
Transformation 1: Vert. stretch by a factor of 2 $|A| = 2$

Transformation 2: Hor. compression by a factor of 3 $B = 3$

Transformation 3: Hor. shift right $\frac{\pi}{6}$ units $C = \frac{\pi}{6}$

What is an equation of this transformation?

$$f(x) = 2 \sin\left(3\left(x - \frac{\pi}{6}\right)\right)$$



11. Describe the three transformations of the graph of $f(x) = \sin(x)$ that result in the sinusoidal graph shown below. Period: $P = \frac{2\pi}{3}$

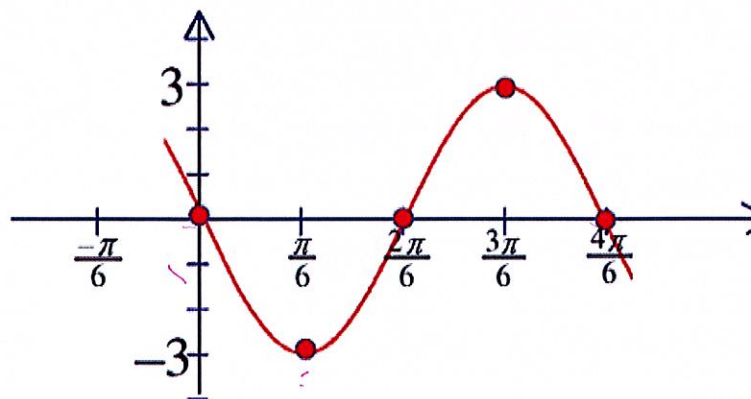
Transformation 1: Vert. stretch by a factor of 3 $|A| = 3$

Transformation 2: Hor. compression by a factor of 3 $B = \frac{2\pi}{3} = 3$

Transformation 3: Hor. shift right $\frac{\pi}{3}$ units $C = \frac{\pi}{3}$

What is an equation of this transformation?

$$f(x) = 3 \sin\left(3\left(x - \frac{\pi}{3}\right)\right)$$



12. Describe the four transformations of the graph of $f(x) = \cos(x)$ that result in the sinusoidal graph shown below. Period: $P = 2\pi$

Transformation 1: Vert. stretch by a factor of 3 $|A| = 3$

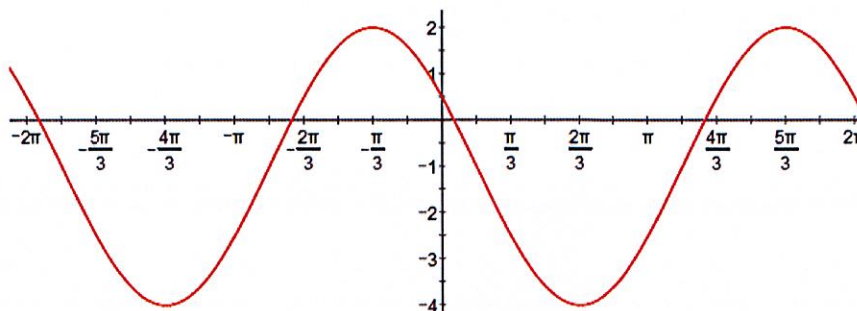
Transformation 2: There is not Hor. stretch/comp $B = 1$

Transformation 3: Hor. shift left $\frac{\pi}{3}$ units $C = -\frac{\pi}{3}$

Transformation 4: Vert. shift down 1 unit $D = -1$

What is an equation of this transformation?

$$f(x) = 3 \cos\left(x + \frac{\pi}{3}\right) - 1$$



13. Describe the four transformations of the graph of $f(x) = \cos(x)$ that result in the sinusoidal graph shown below. Period: $P = 5$

Transformation 1: Vert. stretch by a factor of 2 $|A| = 2$

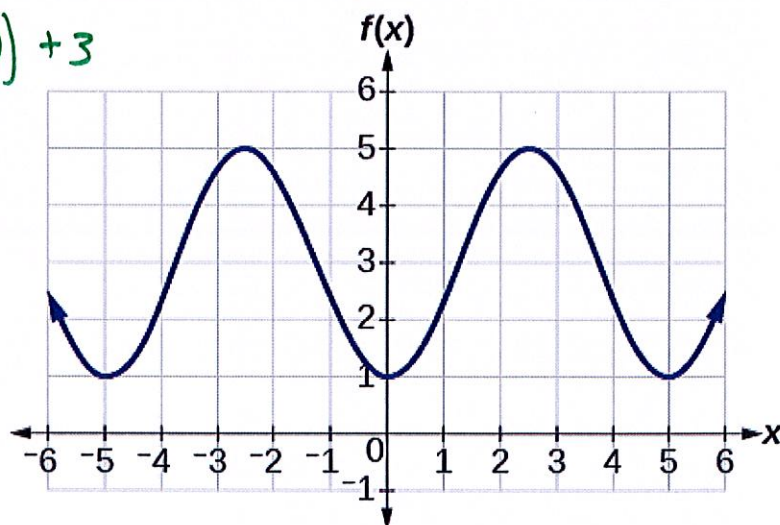
Transformation 2: Hor. Compr. by a factor of 5 $B = \frac{2\pi}{5}$

Transformation 3: Hor. shift 2.5 units to the right $C = 2.5$

Transformation 4: Vert. shift up 3 units $D = 3$

What is an equation of this transformation?

$$f(x) = 2 \cos\left(\frac{2\pi}{5}(x - 2.5)\right) + 3$$



14. Describe the four transformations of the graph of $f(x) = \cos(x)$ that result in the sinusoidal graph shown below. Period: $P = 6$

Transformation 1: Vert. stretch by a factor of 3 $|A| = 3$

Transformation 2: Hor. Compr. by a factor of 6 $B = \frac{2\pi}{6} = \frac{\pi}{3}$

Transformation 3: Hor. shift right 1 unit $C = 1$

Transformation 4: Vert. shift down 2 units $D = -2$

What is an equation of this transformation?

$$f(x) = 3 \cos\left(\frac{\pi}{3}(x - 1)\right) - 2$$

